

Kangley-Echo Lake Transmission Line Project

Draft

Environmental Impact Statement

Bonneville Power Administration

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Responsible Agency: U.S. Department of Energy, Bonneville Power Administration (BPA)

Title of Proposed Project: Kangley-Echo Lake Transmission Line Project

State Involved: Washington

Abstract: BPA proposes to construct about nine miles of new 500-kilovolt (kV) transmission line in central King County, Washington. The new line would connect to an existing transmission line near the community of Kangley, and then connect with BPA's existing Echo Lake Substation. The major reason for this proposal is to improve system reliability in the King County area. Within two to three years, an outage on the existing line between Raver and Echo Lake substations could overload transformers in the Covington area during times of heavy use, such as during a winter cold snap. An outage could then cause voltage instability and a loss of power in the King County area. Under normal growth in demand, system instability could develop as early as the winter of 2002-03.

Besides meeting this need for system reliability, this project would enhance the United States' delivery of power to Canada as required under the Columbia River Treaty of 1961.

Several alternative routes for a new transmission line are being considered. The action alternatives are east of BPA's existing 500-kV line that runs between Raver and Echo Lake substations. Under all action alternatives, BPA would need to acquire easements for new right-of-way and access roads. Echo Lake Substation would be expanded about three acres to the east and new equipment to accommodate the new line would be installed.

The Proposed Action (Alternative 1) is nine miles long. This alternative was proposed because it would be located immediately parallel to the existing Raver-Echo Lake 500-kV Transmission Line. Locating a new line next to this existing line would minimize the amount of clearing that would be necessary for the new line and minimize the need to build additional access roads.

Alternative 2, 4A and 4B would originate from a tap point about 1.5 miles east of the tap point for the Proposed Action. Each alternative would traverse northwest and connect with the Proposed Action before continuing north and paralleling the existing Raver-Echo Lake Transmission Line into Echo Lake Substation.

Alternative 3 would begin at the same tap point as Alternative 2. From this point, it would traverse northeasterly, then turn north-northwesterly to Echo Lake Substation. This alternative would be about 10.2 miles long. It would require additional clearing because none of the route is next to the existing line.

BPA is also considering a No Action Alternative.

For additional information, contact:

Gene Lynard (KECN-4), Project Environmental Lead
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97208
Telephone: (503) 230-3790
Email: gplynard@bpa.gov

For more copies of this document, please call 1-800-622-4520 and ask for the document by name. The document is also available on the Internet at: www.efw.bpa.gov.

For additional information on DOE NEPA activities, please contact Carol Borgstrom, Director, Office of NEPA oversight, EH-25, U. S. Department of Energy, 1000 Independence Avenue S.W., Washington D.C. 20585, phone: 1-800-472-2756.

Summary

In this Summary:

- The Purposes and Need for Action
- Alternatives
- Affected Environment
- Impacts

➤ For Your Information

Words in **bold** and *italics* are defined in Chapter 9, Glossary and Acronyms. Some are also defined in sidebars.

A **kilovolt** is one thousand volts.

A **megawatt** is one million watts, or one thousand kilowatts. A megawatt is enough power to light 10,000 100-watt lightbulbs.

Voltage is the driving force that causes a current to flow in an electrical circuit.

A **brownout** is a partial reduction of electrical voltages that causes lights to dim and motor-driven devices to lose efficiency.

A **blackout** is the disconnection of the source of electricity from all electrical loads in a certain geographical area.

This summary covers the major points of the draft **Environmental Impact Statement (EIS)** prepared for the Kangley-Echo Lake Transmission Project proposed by the Bonneville Power Administration (**BPA**). The project involves constructing a new 500-kilovolt (**kV**) line in central King County, Washington. The new line would connect an existing line near the community of Kangley to BPA's existing Echo Lake Substation nine miles to the north (see Map 1). The project would also involve expansion of that substation to accommodate the new transmission line. As a federal agency, BPA is required by the National Environmental Policy Act (**NEPA**) to take into account potential environmental consequences of its proposal and take action to protect, restore, and enhance the environment during and after construction. Preparation of this EIS assists in meeting those requirements.

S.1 Purposes and Need for Action

S.1.1 Background summary

BPA's existing transmission system in the Puget Sound area provides reliable power to customers throughout the Northwest, and to other regions and Canada. As population grows, however, the need for electrical energy increases. Winter **loads** in the Puget Sound area alone are forecasted to increase 150-200 **megawatts (MW)** per year over the next decade, an average annual growth rate of 1.6 percent.

BPA is required to ensure its transmission system can reliably serve customer power needs under all operating conditions, including times of **peak use** (maximum demand). BPA system planners now anticipate peak use could exceed existing system capacity as soon as the winter of 2002-03. When system capacity is exceeded, the **voltage** on transmission lines can drop below acceptable levels, causing **brownouts**, or can cause automatic devices to disconnect lines and cut off power entirely, causing a **blackout**. To avoid these unplanned outages, system operators may try selectively **dropping** or **shedding loads**, purposefully disconnecting some customers to

prevent equipment damage or widespread loss of load. Whether planned or unplanned, electrical outages can be inconvenient, costly and even dangerous to customers, especially in winter.

Consequently, BPA needs to improve its transmission system to ensure continued reliable electrical power for Puget Sound area customers and other regions.

S.1.2 BPA's Purposes

"Purposes" are goals to be achieved while meeting the need for the project. These objectives are used to evaluate alternatives proposed to meet the need. BPA will use the following purposes to choose among the alternatives:

- Increase BPA system capacity while maintaining BPA transmission system reliability;
- Maintain environmental quality;
- Minimize impacts to the human environment through site selection and transmission line design;
- Minimize costs while meeting BPA's long-term transmission system planning objectives for the area.

S.2 Alternatives

BPA did long-range (5- to 10-year) studies to determine what actions could meet the needs, what each would cost, and how each could affect the transmission system. Several alternatives were identified. These alternatives — the Proposed Action (Alternative 1), and Alternatives 2, 3, 4A and 4B — are discussed in this EIS, as well as the No Action Alternative.

S.2.1 Proposed Action

➔ For Your Information

A **single-circuit** line has one electrical circuit per structure.

Tap - point at which a transmission line is connected to a transmission line, substation, or other electrical device to provide service to a local load.

BPA proposes to build a **single-circuit** 500-kV transmission line from a **tap** point on its Schultz-Raver No. 2 500-kV line near Kangley, Washington, to its Echo Lake Substation near North Bend, Washington. The proposed route for this line, also called Alternative 1, is nine miles long. In addition, Echo Lake Substation would be expanded about three acres to the east and new equipment installed there to accommodate the new line.

This alternative was proposed because it would be located immediately parallel to an existing 500-kV transmission line, the Raver-Echo Lake Transmission Line. Locating a new line next to an existing one minimizes right-of-way clearing needed for the new line and reduces construction of additional **access roads** (only 1.5 miles of

new access roads needed). However, the Proposed Action would displace two residences and a barn near Kangley, and impact a proposed subdivision.

Cost of the Proposed Action is \$11.5 million plus \$6.5 million for the substation expansion.

The following equipment and activities would be part of the Proposed Action (most are shared in common with the other alternatives):

S.2.1.1 Transmission Structures

About 40 ***lattice steel*** transmission towers would support the 500-kV transmission line. These structures average 135 feet high, with the average span between towers about 1,150 feet.

Transmission towers are normally assembled in sections at a tower site, disturbing an area of about 150' by 200', and lifted into place by a large crane. Depending on topography, sometimes they are assembled at remote staging areas and lifted into place by sky-crane helicopters. Towers are attached to the ground with ***footings***, buried metal assemblies at each corner. A trackhoe is used to excavate an area for the footings and then to backfill the area.

S.2.1.2 Conductors and Insulators

Conductors, wires that carry electrical current on a transmission line, are suspended from towers with ***insulators***. Insulators are made of nonconductive materials (porcelain or fiberglass) that prevent electric current from passing through the towers to the ground. Conductors are installed on the insulators, often by helicopter, after the towers have been built. Then two overhead ***ground wires*** are attached to the top of the towers for lightning protection. There is also a series of wires (called ***counterpoise***) buried in the ground at each structure to establish a low resistance path to earth, usually for lightning protection. Finally, one fiber optic cable needed for communications is strung on the new line.

➞ For Your Information

Ground wire is wire that is strung from the top of one structure to the next; it shields the line against lightning strikes.

S.2.1.3 Right-of-Way Clearing

BPA would acquire easements to build, operate and maintain the new transmission line across public and private properties. The Proposed Action would require 150-feet of new right-of-way (***ROW***) over nine miles.

If tall trees outside the 150-foot easement could fall and damage the line, BPA would acquire rights that allow BPA to remove these “***danger trees***.” BPA would also acquire rights to use private roads to access the transmission line ROW. When no existing roads are near

the ROW, BPA would acquire an access road easement that allows BPA to construct a new road.

For safe and uninterrupted operation of the transmission line, vegetation within the ROW would then need to be cleared. BPA would develop a clearing plan to guide the construction contractor hired to clear off and on the ROW. The plan would specify the allowable vegetation heights along and at varying distances from the line. Generally, all tall-growing vegetation (trees and woody brush) would be removed from the 150-foot right-of-way, as well as identified danger trees outside the ROW.

Where the Proposed Action crosses the Cedar River Watershed (*CRW*), BPA is considering using different clearing criteria that would take fewer trees. This “stable tree” criteria would leave trees considered stable in place, even though they may be tall enough to fall into the transmission line. BPA is weighing the benefits of this against the risks. Its decision will be included in the final EIS.

S.2.1.4 Access Roads

Easements — BPA normally acquires access road easements and develops and maintains permanent road access to each of its transmission line structures. Surfaced with crushed gravel, access roads are designed for trucks and equipment used during construction and maintenance of the line and may include short *spur roads* (roads that go to a structure if the structure is not located on a trunk road). Easements for new roads outside the proposed transmission line ROW would be 50 feet wide, which includes the road and about 10 feet on both sides disturbed for drainage ditches, etc. Precise access road locations would be coordinated with landowners to minimize impacts on property.

Stream Crossings — New and existing access roads may cross rivers and both perennial and intermittent streams. No new bridges would be built.

Gates — Access roads that cross private timberlands and lands managed by the Cedar River Municipal Watershed would be gated and locked in accordance with the wishes of landowners and land managers.

S.2.1.5 Staging Areas

During construction of the line, areas would be needed off the main highways, near the existing ROW, where equipment and supplies such as tower steel, spools of conductor wire, and other materials could be stored until used. The contractor(s) in charge would secure temporary rights to establish staging areas somewhere near the center and at both ends of the proposed line.

➞ For Your Information

A **bay** is an area set aside in a substation for special equipment.

S.2.1.6 Substation Facilities

Expansion of the existing Echo Lake Substation would include construction of a new 500-kV **bay** (terminal) on BPA property east of the substation. The size of the expansion would be 150 feet by 750 feet. The site would be cleared, fenced and graded. A short section of the existing road around the substation would be realigned to the east.

S.2.1.7 Maintenance

Once the new line is built, BPA would manage vegetation on the new rights-of-way as it does on existing ROWS and substation sites. This includes manual, mechanical, biological and chemical (herbicide) maintenance activities. BPA uses an integrated vegetation management (**IVM**) approach, which looks at existing environmental conditions and selects a vegetation management strategy best suited to these conditions. If threatened or endangered fish, animal, or plant species listed under the Endangered Species Act are found along a transmission line route, buffer zones are defined around these areas and no herbicides are used. This practice also applies to riparian areas. The IVM plan would insure that the mitigation measures identified in the EIS and implemented during construction would be carried forward and maintained throughout the life of the line.

At the landowner's request, no herbicides would be used in the Cedar River Watershed. BPA has not used herbicides in the Watershed for the past 15 years.

S.2.2 Alternative 2

Alternative 2 would originate from a tap point about 1.5 miles east of the tap point for the Proposed Action and traverse northwest about three miles before continuing north paralleling the existing Raver-Echo Lake Transmission Line into Echo Lake Substation. This alternative would be approximately nine miles long.

Alternative 2 has all the components of the Proposed Action, but would require more (about 2.3 miles) of additional new access roads. It would also require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 2 was explored because it would avoid impacting two residences and a small subdivision affected by the Proposed Action.

The estimated cost for Alternative 2 is the same as the Proposed Action - \$11.5 million for the transmission line and \$6.5 million for the substation expansion.

S.2.3 Alternative 3

Alternative 3 would begin at the same tap point as Alternative 2. From this point, it would traverse northeasterly then turn north-northwesterly to Echo Lake Substation. This alternative would be about 10.2 miles long, or about 1 1/4 miles longer than the Proposed Action. It would also require additional clearing because none of the route is next to the existing line. **Alternative 3** was considered to better meet the Western Systems Coordinating Council's (*WSCC*) reliability criteria, which recommend a minimum of 2,000 feet separation between new transmission line rights-of-way with at least one common terminal. Separation provides increased system reliability.

Alternative 3 has the same components as the Proposed Action, but requires about 6.4 miles of new access roads, almost five miles more than the Proposed Action. This alternative was also explored because it would meet the WSCC requirement for separation between 500-kV lines.

The estimated cost for Alternative 3 is the highest of all alternatives, \$14.5 million for the transmission line and \$6.5 million for the substation expansion.

S.2.4 Alternative 4A

Alternative 4A would begin at the same tap point as Alternative 2. About one-third of the way along Alternative 2, this alternative turns northwest to connect with the Proposed Action. Alternative 4A has the same components as the Proposed Action, with about the same transmission line length (9.5 miles), but greater new access road requirements (2.3 miles). It would require additional clearing because part of the route would be on new ROW, not next to the existing line. It was considered to avoid the two residences and the small subdivision adjacent to the Proposed Action, while avoiding a second separate crossing of the Cedar River further upstream from the existing crossing.

The estimated cost for Alternative 4A is \$12 million for the transmission line and \$6.5 million for the substation expansion.

S.2.5 Alternative 4B

Alternative 4B would begin at the same tap point as Alternative 2. About half way along Alternative 2, this alternative would traverse southwest to connect with the Proposed Action. Alternative 4B has the same components as the Proposed Action, with an equivalent transmission line length (9.2 miles) and slightly more new access roads (1.8 miles). It would also require additional clearing because

part of the route would be on new ROW, not next to the existing line. **Alternative 4B** was considered for the same reasons identified in Alternative 4A, plus the added benefit of taking advantage of established clearing in the watershed for the existing 115-kV transmission line parallel to Pole Line Road, and using this county road for access to the proposed power line.

The estimated cost for Alternative 4B is \$12.5 million for the transmission line and \$6.5 million for the substation expansion.

S.2.6 No Action Alternative

The No Action Alternative is often called the no-build alternative. The environmental impacts described for each of the action alternatives above would not occur. The No Action Alternative does not preclude the need for future transmission projects. It means only that no line would be considered for construction in this general area in the near future.

S.2.7 Alternatives Considered but Eliminated from Detailed Study

A wide variety of alternatives were considered. The following were eliminated when they were judged to not meet the purpose and need:

- **Building an underground transmission line** — Excessively high costs (as much as 10 times more) of this option prevented its further consideration. BPA considers undergrounding a tool for limited, special situations.
- **Increasing local generation** — There are no plans for new generating plants in the project area. If there were, they would have their own environmental impacts. While there are plans for new plants east of the Cascade Mountains, those could eventually require even more transmission line capacity.
- **Energy conservation** — While BPA- and utility-sponsored conservation programs in the region have helped to reduce power demand, the magnitude of savings that can be accomplished is too small to defer the need for the new transmission line.
- **Load curtailment plan** — BPA has a curtailment plan in place that calls for cuts to firm transmission customers in the Puget Sound area when system conditions (such as a potential overload) require. While this plan can reduce load temporarily to protect the system, it is not a reasonable long-term solution to the region's additional transmission needs.

- **Transmission line route variations** — Five other transmission line routes, some proposed by the public during the environmental *scoping* process, were initially discussed. They included (1) rebuilding the Covington-Maple Valley 230-kV Transmission Line (rejected due to technical limitations); (2) rebuilding a portion of the single-circuit Rocky Reach-Maple Valley Transmission Line (rejected for high cost - \$58-\$60 million); (3) building a new 500-kV line starting near Stampede Pass (rejected for high cost - \$48 million); (4) building a new 500-kV line around the west side of the Cedar River Watershed through Hobart and Ravendale (rejected due to high costs and high impacts on developed land uses and residents); and (5) expanding the Covington Substation and rebuilding existing transmission lines in the area (rejected for high cost).

S.3 Affected Environment

S.3.1 Land Use

The entire project area is within unincorporated King County. Local land-use planning is under the county's jurisdiction. Most of the land in the project vicinity is forested and is managed for timber production and/or watershed protection (the 90,546-acre Cedar River Watershed). Other uses in the vicinity of the project are mineral extraction (aggregate), and rural residential. The unincorporated communities of Kangley and Selleck are near the south end of the project area, and a housing development called Halmar Gates is near the north end.

The City of Seattle owns the Cedar River Watershed and restricts human access within it. Watershed boundaries are posted, and all road access points are gated and locked. To comply with the federal *Endangered Species Act (ESA)*, the city has a multi-species *Habitat Conservation Plan (HCP)* in place that sets mitigation and conservation commitments for water supply, hydroelectric power supply, and watershed management activities. These commitments are intended to offset any harm caused to individual listed *threatened* and *endangered species* and selected unlisted species by promoting conservation of populations as a whole. The HCP also allows no commercial logging. The watershed is managed as an ecological reserve.

The Washington State Department of Natural Resources (*DNR*) owns two blocks of land within the project area totaling 720 acres. Both properties are covered under the Rattlesnake Mountain Scenic Area Management Plan and are categorized as "Managed Lands." DNR manages the properties for timber production in accordance

with the DNR's Final Habitat Conservation Plan (September 1997), which provides mitigation for incidental take permits for two federally-listed species. Activities allowed on DNR-managed forestlands include timber harvesting, commercial thinning, reforestation and non-timber activities, such as granting rights-of-way.

Private property owners in the area include Weyerhaeuser Company, Weyerhaeuser Real Estate Company (**WRECO**), Fruit Growers Supply, Plum Creek Timber Company, Trillium Corporation and several individual landowners owning smaller parcels near the routes of the various alternatives.

Transportation facilities in the area include Interstate 90 (I-90) and State Route 18 (SR 18). The City of Seattle owns and maintains the roadways and bridges within the Cedar River Watershed. Other roads in the area are county roads or roads owned by large private landowners such as Weyerhaeuser. There are no active rail lines in the project area, but there are several abandoned railroad rights-of-way. There are no aircraft facilities within the study area.

S.3.2 Recreation

There are no developed recreation sites within the project area and little **dispersed recreation** occurs. This is because most of the project area is within the restricted Cedar River Watershed and on private timberlands. Recreation is concentrated outside the study area along the Snoqualmie River to the northeast, the Cedar River west of the Landsburg Diversion Dam, east of Chester Morse Lake in the Mt. Baker-Snoqualmie National Forest (North Bend Ranger District), and the Tiger Mountain State Forest to the northwest. There is likely some dispersed recreation use in the project area.

S.3.3 Geology and Soils

The topography, geology, and soils of the project area are key factors affecting the susceptibility of different areas to erosion and sedimentation. Erosion and sedimentation can cause degradation of water quality and affect fisheries and other habitat.

Topography — The project area consists of a southern lowland area in Green Valley and a northern mountainous area, which includes Taylor Mountain, Brew Hill, Rattlesnake Mountain, and the intervening Raging River Valley. The Cedar River is the principal stream in the southern lowland area. Its headwaters are east and southeast of the project area and the river flows generally northwest to Renton, where it discharges into Lake Washington. Several smaller streams drain to the south into the Cedar River, including Rock, Williams, and Steele creeks.

The northern mountainous area consists of relatively low rounded mountains with moderate slopes and intervening valleys. Rattlesnake Mountain is the highest point next to the project area, with a summit elevation of 3,517 feet. The Raging River is the principal stream in the northern mountainous area. It flows north through a broad, U-shaped valley between Brew Hill and Taylor Mountain to the west and Rattlesnake Mountain to the east.

Geology and Soils — The project area is along the western margin of the South Cascade Range, which are composed primarily of volcanic, **volcaniclastic** and associated sedimentary rocks that have folded and faulted over the years. Continental glaciers have contributed to the resulting surface deposits and landforms. Soils are typical of those found in the western Cascades of Washington, including soil deposited directly by streams and rivers, glaciers and **glacial outwash** streams; residual soils (an accumulation of rock debris and soil formed by weathering); **colluvial** soil transported downslope; and volcanic ash from nearby Cascade volcanoes that mixed with the other soil types.

Seismology — The project site is in a moderately active earthquake region that has been subjected to many quakes of low to moderate strength, and occasional strong shocks, during the Pacific Northwest's 170-year historical record. Recently, the area experienced a 6.8 earthquake centered near Olympia. The **seismicity** of the region results from the ongoing **subduction** of the Juan de Fuca Plate beneath the North American Plate along the Cascadia Subduction Zone.

S.3.4 Water Resources

Precipitation — Most precipitation in the project area falls as rain in the southern lowlands, while a mixture of rain and snow falls on the upper portions of the northern mountainous area. Annual precipitation averages between 60 and 80 inches; 75 percent falls between October and April.

Floodplains — The Federal Emergency Management Agency (**FEMA**) has not mapped floodplains in the project area. However, based on FEMA mapping along the Cedar River a short distance downstream from the project area, it appears the 100-year floodplain is limited to a narrow area along the active Cedar River channel.

Groundwater — There are no **sole-source aquifers** designated by the Environmental Protection Agency (**EPA**) in the project area. There are domestic wells within the project area serving the communities of Selleck and Kangley on the south and Halmar Gates to the north.

➞ For Your Information

Anadromous fish — Chinook, coho and sockeye salmon and steelhead trout, which hatch in fresh water, spend part of their life at sea, and then migrate up rivers to their home waters to spawn.

Water quality — The project area includes portions of the Cedar River Watershed (CRW), where water quality is very high. Both water quality and quantity are important components of the CRW's ability to provide a clean and reliable drinking water supply. Also, no water bodies in the project area are listed on the Washington State 303(d) water quality list (a list of water bodies that do not meet standards established by the Federal Clean Water Act).

S.3.5 Fisheries

Each of the alternatives would cross some fish-bearing streams and an unknown number of non-fish-bearing streams.

The fish resources in the study area include resident and **anadromous** species. Resident species live their life cycles within the watershed. Anadromous species are hatched in freshwater, then spend part of their life at sea before returning to their home waters to spawn.

Along the route of some alternatives, surrounding trees and vegetation produce conditions well suited as anadromous fish-rearing habitat. Other streams support only resident fish. Shade produced by forest stands adjoining these fish-bearing streams are often a primary control on water temperature and fish habitat health.

S.3.5.1 Special-Status Fish Species

Special-status fish species include those that are listed, proposed, or candidates for listing as threatened or endangered under the federal ESA, or that are regarded as species of concern by the USFWS, or that are listed as species of concern (including endangered, threatened, sensitive and candidate categories) according to the Washington Department of Fish and Wildlife (**WDFW**).

Federally Listed Species — All action alternatives could affect two species of fish recently listed as either threatened or endangered under the ESA. The Puget Sound **Evolutionarily Significant Unit (ESU)** chinook salmon is listed as threatened and its critical habitat and supporting **riparian habitats** must be protected. The Puget Sound **distinct population segment (DPS)** bull trout is also listed as threatened. Both chinook salmon and bull trout are potentially, though not likely, present in streams crossed by each of the action alternatives.

Federal Candidate Species — All action alternatives could affect one species of fish that is a candidate for listing under the ESA: the Puget Sound/Strait of Georgia ESU coho salmon. Coho salmon are potentially, though not likely, present in streams crossed by each of the action alternatives.

Federal Species of Concern — The USFWS has identified the Pacific lamprey and river lamprey as species of concern potentially occurring in the project area. Both Pacific and river lamprey are potentially present in streams crossed by each of the action alternatives.

Essential Fish Habitat — All action alternatives could affect two fisheries protected by federal Essential Fish Habitat (**EFH**) provisions: the chinook salmon and coho salmon fisheries. All streams in the project area are included in designated EFH for these two fisheries. Some streams are included because they may support spawning, rearing and migratory use by chinook and coho salmon. Others are included because they are situated upstream of areas used by salmon, and the salmon are sensitive to water quality in these streams.

Washington State Special-Status Species — Chinook salmon, bull trout, and river lamprey are state candidates for listing by the WDFW.

S.3.6 Wildlife

Analysis of wildlife focused on species on the west side of the Cascade Mountains that are: federally-listed as threatened or endangered; federal species of concern; and Washington state listed threatened, endangered, sensitive or monitor species. Species found in the project area include:

Forest Community Dependent Species — A number of forest community species, including *invertebrates*, were identified as potentially occurring within (e.g., nesting in, foraging in, or traveling through) the project area. These include northern spotted owls, northern goshawks, merlins, pileated woodpeckers, Vaux's swifts, band-tailed pigeons, blue grouse, fisher, five species of bats, and four species of terrestrial mollusks.

Riparian Community Dependent Species — Seven riparian community species were identified as potentially occurring within the project vicinity. They include: bald eagle, great blue herons, osprey, willow flycatchers, harlequin ducks, mink and Van Dyke's salamanders.

Aquatic Community Dependent Species — Seven aquatic community species were identified as potentially occurring within the project vicinity. These include: the Cascades frog, northern red-legged frog, Cascade torrent salamander, Oregon spotted frog, tailed frog, western toad and Fender's soliperlan stonefly.

Species Dependent on Unique Habitats — One wildlife species, the Larch Mountain salamander, was identified as potentially occurring within the project vicinity and having a primary association with unique habitat types.

Early Seral Community Dependent Species — Three wildlife species preferring young forest surroundings were identified as potentially occurring within the project vicinity: elk, black-tailed deer, and western bluebirds.

S.3.7 Vegetation

For this study, vegetation was studied within a 0.5-mile corridor centered on the ROWs of the Proposed Action and alternatives. For all alternatives, the ROW would be 150 feet wide.

Twelve vegetation cover types were defined and mapped. They include three stages (ages) of coniferous forest (young plantations, medium-age stands, and those in late stages of growth); three stages of deciduous forest (young, medium-aged, and late growth); two stages of mixed forest (young and medium-aged); wetlands; natural non-forested areas; water bodies (lakes, rivers, streams); and developed cover type (such as residential landscape).

Two general characterizations can be made of the study areas for all action alternatives. First, moving south to north, vegetative cover type tends to change from conifer-dominated stands to mixed conifer-deciduous stands. Second, stand age tends to fall as one proceeds north along the alternatives.

The Proposed Action is dominated by coniferous forest stands in late stages of growth (36 to 75 years old). The north leg of the Proposed Action tends to be mixed coniferous-deciduous forest. This is also true of Alternatives 2, 4A and 4B, since they share the northern two-thirds of the Proposed Action's route. The south leg of the Proposed Action has more conifer-dominated stands. The south ends of Alternatives 2, 4A and 4B also pass through conifer forest, but in some cases, very young Douglas fir plantations.

Alternative 3 differs from the other alternatives in the age and vegetative cover types encountered. In general, it passes through older (two stands are more than 70 years old), more coniferous forested and less non-forested areas. There are no older deciduous stands.

The area around Echo Lake Substation is grass/forb/shrub, with small mixed coniferous-deciduous stands. The perimeter area to about 100 feet around the substation is surrounded by gravel and non-native grasses.

S.3.8 Wetlands

Wetlands perform many important functions, including flood storage and flood flow moderation, filtering pollutants and sediments before they enter streams, and providing foraging, breeding, cover, and rearing habitat for many wildlife species.

The study area for wetlands included a 500-foot wide corridor along all of the transmission line alternatives. A total of 23 wetlands were identified within the proposed 150-foot ROW of the alternatives. Wetland vegetation classes included palustrine **emergent**, scrub-shrub, open water, and forested wetlands.

All the alternatives would cross some wetlands. In addition, a portion of one wetland about a half-acre in size is located within the footprint of Echo Lake Substation expansion.

S.3.9 Visual Resources

The visual project area includes three landscape types: the Cedar River Watershed, private timberlands, and rural residential uses and pastureland in the unincorporated communities of Kangley, Selleck, and Halmar Gates.

All action alternatives travel through the heavily forested Cedar River Watershed. Access to the watershed is restricted, and little human activity (including dispersed recreation) occurs within the watershed boundaries. The watershed is forested primarily by evergreen conifers, which provide some visual screening of the existing Raver-Echo Lake 500-kV Transmission Line and towers. No commercial timber harvesting is permitted within the boundaries of the watershed. Public access is by permission only.

Private timberlands are primarily along the northern portion of the alternatives with some additional private timberlands at the southern end of Alternatives 2, 3, 4A, and 4B. Most of the private land north of the Cedar River Watershed has been logged in recent years and is in the **early-successional** (0 to 35 feet high) classification. Again, human activity and dispersed recreation is limited.

Rural residential lands are located in the southern portion of the project area, in the unincorporated communities of Kangley and Selleck. In Kangley, the existing transmission lines are relatively close to some houses. All Schultz-Raver lines, and the Raver-Echo Lake line, are clearly visible from almost all properties and dominate the landscape. No existing transmission lines are visible to Selleck residents, who are screened by heavy forest, nor to residents of another rural residential neighborhood just north of the watershed west of Alternative 3, known as Halmar Gates. That area is also surrounded by heavily forested areas.

There are no residences or recreation sites with a view of Echo Lake Substation.

S.3.10 Socioeconomics

King County is the most populated county in Washington, with most of its population concentrated in the large Seattle metropolitan area. King County and the state have both experienced substantial increases in their populations since 1960, with growth rates exceeding the national average. That growth is expected to continue, but at a slower rate than recent decades.

The project area is within the rural area of King County, about 15 miles east of the suburban cities of Kent and Renton. The small, rural cities of Maple Valley, Black Diamond, Snoqualmie and North Bend are the nearest incorporated communities. In addition, the unincorporated residential communities of Selleck and Kangley, plus several other residential enclaves, occur within the project area or in the vicinity. The development density of these residential areas is generally rural, ranging between one dwelling unit per 4 acres and one dwelling unit per 23 acres.

Household median income in King County is \$57,000, well above the state household median income of \$46,000 in 1998, the latest information available. Household income in the census tracts crossed by the project alternatives had fewer households below the poverty level than did King County as a whole.

The ethnicity of the project vicinity is predominantly Caucasian and the remainder primarily African-American, American Indian, and Asian-Pacific Islander. King County as a whole has a higher minority population, greater than 15 percent, than does the project vicinity, which is less than 3 percent.

The main economic activities in King County are manufacturing, shipping and trade, agriculture, business services, shipbuilding, fishing, wood products, and tourism. Employment forecasts anticipate recent growth will likely continue, with moderate job growth in King County. The county has consistently had lower rates of unemployment than the statewide average during the last decade.

S.3.10.1 Cultural Resources

The project area is rich in cultural history. Portions of the project area have been and continue to be used traditionally by members of many Indian tribes. Members have used the area for camping, fishing, hunting, gathering berries, trading with other tribes and as a traveling route. However, no previously recorded cultural resource sites occur on or near (within 700 feet) of the proposed BPA project area. The Selleck National Historic District is the closest cultural resource site, and is separated from Alternative 2 by a road and more than 700 feet.

Of the cultural resources identified through archival and map research, only the former Barneston townsite (including Hemlock and the related Japanese settlement) and the Pedro Felise cabin (no longer standing) occur on or within the 150-foot right-of-way of BPA's proposed alternative routes. The probability for encountering prehistoric cultural resources along any of the four action alternatives varies by landform and increases along the Cedar River.

There is a high probability of encountering historic-period cultural resources in the project area, such as remnants of historic-period logging activities. Many historic-period cultural resources have been identified in archival sources and maps, although few have been formally inventoried or even verified on the ground by cultural resource professionals.

S.3.11 Noise, Public Health and Safety

S.3.11.1 Transmission-line Noise

Audible noise — usually characterized as a hissing, crackling sound sometimes accompanied by a hum — can be produced by transmission lines. Usually this happens during foul weather which, based on meteorologic records near the route of the proposed transmission line, is expected to occur less than 9 percent of the time.

Along the alternative routes of the proposed 500-kV transmission line, existing noise levels depend on land use and on whether there is an existing transmission line. Background noise levels in remote areas depend on ambient conditions: wind, raining, traffic or other human activity nearby. For example, levels associated with rain on foliage will be up to 50 dBA. During foul weather, median levels of audible noise from an existing 500-kV line at the ROW edge would be about the same (50 dBA).

BPA design criterion for median levels of audible noise during foul weather is 50 ± 2 dBA at the edge of the right-of-way. This meets the Washington Administrative Code maximum noise level permitted for industrial uses of 60 dBA during the day and 50 dBA at night. King County additionally defines a rural area where the maximum sound arising from an industrial area (say, a transmission line) is limited to 57 dBA, with a reduction to 47 dBA during nighttime hours and on weekends and holidays.

S.3.11.2 Electric and Magnetic Fields (EMF)

Transmission lines, like all electrical devices and equipment, produce EMF. While electric-field strength tends to be constant, magnetic-field strength can vary depending on the design of and

distance from the line, the amount of electrical load on the line, and even meteorological factors. In all cases, field strength decreases rapidly with distance.

There are no national standards for EMF from power facilities such as transmission lines. Washington does not have a standard. BPA has an electric field standard of 9kV/m maximum on the ROW and 5kV/m at the edge of the ROW, which it applies to all transmission lines, including those already existing in the study area.

S.3.11.3 Toxic and Hazardous Substances

Because a transmission line and substations already exist in the project area, routine maintenance procedures for such facilities are already occurring. These generate minimal amounts of hazardous waste. BPA uses herbicides sparingly when managing vegetation in rights-of-way. All herbicides used by BPA must be approved by the EPA and must also go through a BPA environmental review process. Only trained crew members are allowed to apply herbicides, and they are required by law to follow label directions. BPA does not use herbicides in the Cedar River Watershed.

S.3.11.4 Fire

BPA already follows all fire control restrictions set by the City of Seattle in the Cedar River Watershed. On its lands, Weyerhaeuser requires that vehicles carry fire suppression tools on its land. To prevent fires and other hazards near transmission lines, BPA maintains safe clearances between the tops of trees and the existing lines in the corridors. Generally, trees are not allowed to grow over 20 feet high on the ROW. BPA also prohibits storage of flammable materials on ROWs.

☞ For Your Information

Corona occurs in regions of high electric field strength on conductors, insulators, and hardware when sufficient energy is imparted to charged particles to cause ionization (molecular breakdown) of the air.

S.3.11.5 Radio/TV Interference

Corona on transmission-line conductors can generate electromagnetic noise in the frequency bands used for radio and television signals. The noise can cause radio and television interference (**RI** and **TVI**). However, correct design of a line can mitigate corona generation and keep radio and television interference at acceptable levels.

S.3.12 Air Quality

The proposed project is within the Seattle-Tacoma Ozone Maintenance Area, and approximately 10 miles east of the Seattle-Tacoma Carbon Monoxide (**CO**) Maintenance Area. The project also is about 10 miles east of Seattle's Urban Growth Boundary.

➔ For Your Information

Mitigation lessens the impacts predicted for each resource. Mitigation may include reducing or minimizing the impacts, avoiding it completely, or rectifying or compensating for the impact.

S.4 Impacts

To analyze potential impacts from construction, operation and maintenance of the Proposed Action and alternatives, resource specialists analyzed actions using a scale with four impact levels: **high**, **moderate**, **low** and **no impact**. The impact discussion also lists **mitigation** that could reduce impacts and **cumulative impacts** of the alternatives.

S.4.1 Land Use Impacts

The **Proposed Action** would cross each of the main land uses in the area: forest production, watershed protection, and rural residential. The majority of land crossed would be forestland, where impacts would be low. It would parallel the ROW of the existing transmission line, converting only negligible amounts of forestland to utility use. It would require the least amount of new access roads - 1.5 miles. However, where it would traverse the communities of Kangley and Selleck, it would displace two residences and a small barn and prevent the development of one lot of a proposed four-lot subdivision. Land-use impact: **moderate**.

Alternative 2 would cross forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.3 miles of new access roads. Land-use impact: **low**.

Alternative 3 would require clearing a separate new ROW, but would cross only forestland, converting negligible amounts to utility use. It would come within 650 feet of two residences on its north end, but placement of the line in the eastern portion of the corridor could minimize this impact. It would require the most new access roads - 6.4 miles. Land-use impact: **low**.

Alternative 4A would cross only forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.3 miles of new access roads. Land-use impact: **low**.

Alternative 4B would cross only forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 1.8 miles of new access roads. Land-use impact: **low**.

No Action Alternative: **no** impact on land use.

S.4.2 Transportation Impacts

All alternatives: **no** impact. Because of tower locations and height clearances for lines spanning roadways, none of the alternatives would restrict future expansion or acquisition of public road or railway ROW.

S.4.3 Recreation Impacts

All construction alternatives (**The Proposed Action** and **Alternatives 2 through 4B**) would have **no** functional impact on recreation. There are no developed recreational sites in the project area that would be interfered with or limited by any of the transmission line routes. There could be a **low** experiential impact by all construction alternatives, because any new line could detract from the expectations of a few hikers, hunters or other area recreationalists.

No Action Alternative: **no** impact on recreation.

S.4.4 Geology and Soils

The **Proposed Action** would predominantly cross soil considered to have only a “slight erosion hazard.” One new access road might cross a stream, but this and other soil impacts would occur primarily during construction and be short-term. Revegetation and other mitigation measures could reduce any minor, localized increases in erosion. Soils impact: **low**.

Alternative 2 would also largely cross soil considered to have only a “slight erosion hazard,” but none of its access roads are expected to cross streams. Like the Proposed Action, its impacts would be short-term, occurring mainly during construction, and could be offset with mitigation measures. Soils impact: **low**.

Alternative 3 would cross mostly soil considered only a “slight erosion hazard,” but would also cross a larger proportion of soil considered a “moderate erosion hazard.” The greater amount of access roads required by this alternative also increases erosion potential. Due to the different geologic features along this route, rock blasting could be required during construction. Soils impact: **moderate**.

Alternatives 4A and 4B would have impacts nearly identical to Alternative 2. Soils impact: **low**.

No Action Alternative: **no** impact on soils.

S.4.5 Floodplains

All action alternatives: **no** to **low** impact. No towers or roads would be built in designated floodplains. Construction activities above stream channels could cause more peak runoff, but only in the short term.

No Action Alternative: **no** impact on floodplains.

S.4.6 Water Quality — Streams

The Proposed Action would result in vegetation clearing that would subject some streams to more sunlight exposure, potentially raising water temperature. However, a relatively small amount of streams (less than 1 percent) would be within newly cleared ROWs. Stream water quality impact: **low**.

Alternative 2 would have largely the same impact as the Proposed Action, but would cross the Cedar River at a lower bank, requiring removal of most trees and brush at this site. Still, the relative amount of river exposed to direct sunlight would be small. Stream water quality impact: **low**.

Alternative 3 would cross the Cedar River at a lower bank, requiring removal of most trees and brush at this site, and would cross a greater number of streams not now disturbed. Still, the relative amount of stream exposed to direct sunlight would be small. Stream water quality impact: **low**.

Alternatives 4A and 4B would have the same impact as the Proposed Action. Stream water quality impact: **low**.

No Action Alternative: **no** impact on stream water quality.

S.4.7 Water Quality — Groundwater

The **Proposed Action** would predominantly pass through forestland not tapped by wells. However, the south end of its route would cross aquifers possibly serving some residential wells. Care would be taken in the application of herbicides in this area and preventive measures taken to avoid fuel and other contaminant spills. Groundwater quality impact: **low**.

Alternative 2 would largely pass through forestland not tapped by wells, except at its south end where it would pass east of residential well users in Selleck. Care would be taken in the application of herbicides in this area and preventive measures taken to avoid fuel and other contaminant spills. However, because of the remote chance an accidental contaminant spill could migrate into groundwater, the impact in Selleck would be potentially greater than elsewhere. Groundwater quality impact: **low** to **moderate**.

Alternative 3 would not pass over any aquifers serving wells. Stream water quality impact: **low**.

Alternatives 4A and 4B would have the same impact as Alternative 2. Stream water quality impact: **low**.

No Action Alternative: **no** impact on groundwater quality.

S.4.8 Fisheries

All construction alternatives: **low to moderate** impact with extensive mitigation. Construction of any line would necessitate careful steps to lessen potential impacts on fish. BPA would ensure that all actions potentially affecting fish habitat — riparian vegetation removal, road construction, culvert installation, bedrock blasting and other soil disturbances — would meet or exceed applicable regulations.

No Action Alternative: **no** impact on fisheries.

S.4.9 Wildlife

All construction alternatives: **low to moderate** impact from vegetation and tree clearing in ROWs, with extensive mitigation to preclude greater impacts. Impacts on specific species are:

- Threatened/endangered/sensitive species — **moderate**. Any reduction in habitat for these species, however small, is considered to have relatively greater impact than reduction in habitat for non-threatened species.
- Forest species — **low**. The relative amount of forest habitat that would be cleared is small and this habitat type is common in the project area.
- Riparian species — **low to moderate**. As above, the relative amount of riparian habitat impacted would be small, but vegetation removal could result in a loss of productivity in adjacent aquatic habitat as well.
- Aquatic species — **moderate**. Line construction could reduce the quantity and quality of both wetland and stream habitat.
- Unique habitat species — **low**. Few if any of these species are likely present in the project area.
- Early seral species — **no to low**. Construction would actually increase habitat for these species, particularly elk and deer, although the increase in foraging habitat would not appreciably benefit western bluebirds.

No Action Alternative: **no** impact on wildlife.

S.4.10 Vegetation

The **Proposed Action** would disturb 152 acres of vegetation. ROW clearing and soil compaction and movement in forested areas would create most impacts, which vary depending on vegetation type. The impact on individual vegetation communities would be low. The impact on coniferous forested communities would be moderate. A potentially high impact from noxious weed colonization in disturbed areas could be mitigated to have a low impact. Overall vegetation impact: **low to high**.

Alternative 2 would disturb 155 acres. Impact is the same as the Proposed Action.

Alternative 3 would disturb 187 acres. Impact is the same as the Proposed Action.

Alternatives 4A would disturb 164 acres. Impact is the same as the Proposed Action.

Alternative 4B would disturb 175 acres. Impact is the same as the Proposed Action.

No Action Alternative: **no** impact on vegetation.

S.4.11 Wetlands

The **Proposed Action** would affect 16 acres of wetlands. Impacts vary depending on wetland type. The impact on forested wetlands due to ROW clearing would be moderate. The impact on scrub-shrub and open water wetlands would be none to moderate. Impacts on wetland water quality and wildlife would be low. Overall wetlands impact: **low to moderate**.

Alternative 2 would also affect 16 acres of wetlands. Impact is the same as the Proposed Action.

Alternative 3 would affect 6 acres of wetlands. Impact is the same as the Proposed Action.

Alternatives 4A would affect 16 acres of wetlands. Impact is the same as the Proposed Action.

Alternative 4B would affect 17 acres of wetlands. Impact is the same as the Proposed Action.

No Action Alternative: **no** impact on wetlands.

S.4.12 Visual Resources

The **Proposed Action** would have varying impacts on the project area's visual resources. The impact on some Kangley residents, for whom the new transmission lines would be a dominant feature, would be moderate to high. The impact on occasional recreationalists would

be low. The impact on motorists in the near vicinity would be low to moderate. Overall visual resources impact: **low to high**.

Alternative 2 would have a moderate impact on some Selleck residents who would be able to see its transmission towers, a low impact on occasional recreationalists, and a low impact on local motorists. Overall visual resources impact: **low to moderate**.

Alternative 3 would have a low to moderate impact on some Kerriston Road residents at the north end of its route, and no to low impacts on occasional recreationalists and local motorists. Overall visual resources impact: **low to moderate**.

Alternatives 4A and 4B would have the same impact as Alternative 2. Overall visual resources impact: **low to moderate**.

No Action Alternative: **no** impact on visual resources.

S.4.13 Socioeconomics

All construction alternatives would have **no to low** impacts on the project area's socioeconomic features. There would be no impact on local lodging, employment, population or business access. Impacts would be low from minor increases in local spending by project workers and removal of a small amount of timberland from production. The project is expected to have marginal impact on overall community values.

No Action Alternative: **high** impact due to the potential for transmission system collapse, brownouts and blackouts affecting not only the immediate Northwest, but regions to the south and north. Commerce and industry would be adversely affected as the quality and reliability of power decreased. Some businesses and their employees could decide to relocate to an area where the power supply is more reliable. Loss of businesses and an unstable power supply could influence whether some people move to the area.

S.4.14 Cultural Resources

The **Proposed Action** would not cross any inventoried or identified cultural resource sites. The potential for unknown sites is minimal due to steep terrain along the route. Cultural resources impact: **low**.

Alternative 2 would cross the western proposed site boundary of the Japanese Camp at Barneston townsite. It would also pass within one-half mile of the Selleck National Historic District. Cultural resources impact: **moderate**.

Alternative 3 would pass near flat land on which historic-period cultural resources are identified on archival maps. Cultural resources impact: **moderate**.

Alternatives 4A and 4B would have low impacts along most of their routes (the portion shared with the Proposed Action). However, they would have moderate impacts where they would cross a highly sensitive landform north of the Selleck National Historic District. Overall cultural resources impact: **low to moderate**.

No Action Alternative: **no** impact on cultural resources.

S.4.15 Noise

All construction alternatives would have **no to low** impact. Incremental noise from the new line would not be discernible in most cases. Alternative 3, which does not parallel an existing line, may produce new, low-level audible noise, but in a largely unpopulated area.

No Action Alternative: **no** impact on noise.

S.4.16 Public Health and Safety

All construction alternatives would have **no to low** impact. Incremental EMF generated by a new line would be minor because most of the land passed through is unpopulated. There would be no impact from toxic or hazardous substances, and only low impacts related to fire danger and radio/TV interference, both of which can be mitigated.

No Action Alternative: **high** impact due to the potential for transmission system collapse, brownouts and blackouts, which could affect public health and safety services, stoplights, security devices, and other vital functions throughout the Puget Sound area.

S.4.17 Air Quality

All construction alternatives would have **no** long-term impact. Minimal, short-term construction impacts would be limited to dust and engine exhaust. No burning of cleared vegetation would be allowed in most of the alternatives; some burning may be allowed along Alternative 3, if approved by the landowners.

No Action Alternative: **no** impact on air quality.

S.4.18 Costs

The **Proposed Action** is estimated to cost \$11.5 million, plus \$6.5 million for the substation expansion.

Alternative 2 is estimated to cost \$11.5 million, plus \$6.5 million for the substation expansion.

Alternative 3 is estimated to cost \$14.5 million, plus \$6.5 million for the substation expansion.

Alternative 4A is estimated to cost \$12 million, plus \$6.5 million for the substation expansion.

Alternative 4B is estimated to cost \$12.5 million, plus \$6.5 million for the substation expansion.

No Action Alternative: no immediate cost impact. However, delaying needed expansion of the transmission system could mean higher system building costs in the future.

